REMARKS

Claims 1 - 24 are presently pending in this Application. With respect to the Claims, the following amendments are presented above:

(a) independent Claim 1 - has been amended to further and/or better define the Applicant's invention, as claimed.

First, the subject matter of Claims 2 and 3 has been incorporated into Claim 1 to define the gelant as being "comprised of a polymer and a cross-linker."

As a result, Claims 2 and 3 have been cancelled and a consequential amendment has been made to Claim 4.

Second, step (b) of Claim 1 has been clarified to claim that the "temporarily stable foam" is introduced into the wellbore "subsequent to first introducing the gelant." Support for this amendment to Claim 1 is found in the Application as filed at: Page 5, lines 12 - 16; Page 11, lines 14 - 25; Page 16, lines 4 - 14; Page 17, lines 1 - 5; Page 17, lines 15 - 26; and Figures 1 and 2;

(b) dependent Claims 21 - 24 - have been cancelled.

Referring to the Final Office Action, Claims 21 - 24 have been rejected by the Examiner pursuant to 35 U.S.C. 112, 1st paragraph, as failing to comply with the written description requirement. As indicated above, Claims 21 - 24 have been cancelled herein. Thus, this rejection of the Examiner has been rendered moot.

Referring further to the Final Office Action, the Examiner has rejected Claims 1 - 24 pursuant to 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,203,834 to Hutchins et. al. in view of U.S. Patent 4,460,627 to Weaver et. al.

It is respectfully submitted that this rejection of the Examiner is overcome by the amendment to independent Claim 1 and the remarks that follow.

Applicant's Invention

The Applicants' invention as claimed in amended independent Claim 1 is directed at a method of reducing water influx into a wellbore, comprising the following steps:

(a) first introducing a gelant into the wellbore, wherein the wellbore is in fluid communication with a subterranean formation, wherein the **gelant is comprised of a polymer and a cross-linker**;

(b) **subsequent** to first introducing the **gelant,** second introducing **a temporarily stable foam** into the wellbore in order to **overdisplace** the gelant from the wellbore and into the formation; and

(c) providing a set-up period to permit the gelant **to set to form a gel block** in the formation and to permit the temporarily stable foam to break down to permit the passage of gas through the foam into the wellbore.

As claimed, the method includes the step of first introducing a gelant into the wellbore and second introducing a temporarily stable foam into the wellbore in order to overdisplace the gelant from the wellbore and into the formation.

The **gelant is comprised of a polymer and a cross-linker**. Thus, in the "first introducing" step, **both the polymer and the cross-linker comprising the gelant are first introduced** into the wellbore. **Subsequent** to first introducing both the polymer and the cross-linker comprising the gelant, **a temporarily stable foam** is second introduced into the wellbore in the "second introducing" step. The second introducing step is performed in order to "**overdisplace the gelant**" (comprised of the polymer and the cross-linker) from the wellbore and into the formation. The gelant **sets** to form **a gel block** in the formation, while the temporarily stable foam break downs to permit the passage of gas therethrough.

"Overdisplacement" is defined in the Application at Page 5, lines 18 - 32 and Page 18, lines 13 - 24, as follows:

"Overdisplacement of the gelant into the formation refers to the movement or displacement of the gelant from the wellbore through which it is initially introduced and away from the near wellbore region into the surrounding formation. ... Further, the overdisplacement is performed in order that the gelant, when set to provide a gel plug or gel block, blocks or inhibits water influx into the wellbore from the water producing zone while not substantially interfering with or hindering gas flow to the wellbore from the gas producing zone or layer of the formation. Further, the overdisplacement is performed in order to provide the temporarily stable foam in the wellbore and the near wellbore region for subsequent collapse or breakdown, as described below. In the event the gelant is not overdisplaced, or is not overdisplaced sufficiently, the resulting gel block will block or prevent both gas and water flow to the wellbore and shut-off the wellbore completely."

"More particularly, in each particular circumstance, the gelant is required to be displaced sufficiently into the formation (24) and away from the near wellbore region of the wellbore (22) to permit the gas (26) to subsequently access the wellbore (22) while inhibiting or reducing the flow of water (20) to the wellbore (22). Thus, the foam must overdisplace the gelant a sufficient distance from the wellbore (22) to permit the establishment of the necessary gas pathways or channels through the foam upon the subsequent breakdown, collapse or de-stabilization of the temporarily stable foam. ... In other words, the overdisplacement is performed sufficiently in order that the set gel block (28) inhibits the water influx from the water producing zone or layer of the formation (24), while the de-stabilized foam permits or provides for gas flow to the wellbore (22) from the gas producing zone or layer of the formation (24).

It is respectfully submitted that neither of the references cited by the Examiner discuss or disclose at least steps (b) and (c) of the Applicant's method as claimed in amended independent Claim 1.

Obviousness (Hutchins et. al. in view of Weaver et. al.)

As stated, the Examiner has rejected independent **Claim 1** and dependent **Claims 2 - 24** for being unpatentable over Hutchins et. al. in view of Weaver et. al. As indicated above, Claims 21 - 24 have been cancelled.

As discussed in *KSR International Co. v. Teleflex Inc.,* 82 USPQ2d 1385 (2007), the determination of obviousness under 35 U.S.C. 103 is a legal conclusion based on factual evidence. The legal conclusion that a claim is obvious depends upon at least four underlying factual issues, as set forth in *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1 (1966): (1) the

scope and content of the prior art; (2) differences between the prior art and the claims at issue; (3) the level of ordinary skill in the pertinent art; and (4) evaluation of any relevant secondary considerations.

Therefore, the test for obviousness must take into consideration the invention as a whole; that is, one must consider the particular problem solved by the combination of elements that define the invention. *Interconnect Planning Corp. v. Feil*, 227 USPQ 543 (Fed. Cir. 1985); *Manual of Patent Examining Procedure* §2143.02. The Examiner must, as one of the inquiries pertinent to any obviousness inquiry under 35 U.S.C. 103 recognize and consider not only the similarities but also the critical differences between the claimed invention and the prior art. *In re Bond,* 15 USPQ2d 1566 (Fed. Cir. 1990).

The fact that a reference teaches away from a claimed invention is highly probative that the reference would not have rendered the claimed invention obvious to one of ordinary skill in the art. *Stranco Inc. v. Atlantes Chemical Systems, Inc.*, 15 USPQ2d 1704 (Tex. 1990).

Moreover, the Examiner must avoid hindsight. The fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggest the desirability of the combination. *Manual of Patent Examining Procedure* §2143.01

The Federal Circuit stated in *In re Kotzab*, 55 USPQ2d 1313 (Fed. Cir. 2000) that:

> "…to establish obviousness based on a combination of elements…there must be some motivation, suggestion or teaching of the desirability of making the specific combination that was made by the applicant…There must be a showing of a suggestion or motivation to modify the teachings of that reference…"

Hutchins et. al. is directed at "foamed gels" having selective permeability to selectively reduce the flow of aqueous fluids (i.e. water) with respect to the flow of non-aqueous fluids (i.e. oil, natural gas) in a subterranean formation (Column 2, lines 3 - 6 of Hutchins et. al.).

Specifically, "a composition capable of forming a foamed gel" and "a gas" are injected into the subterranean formation. **The interaction of the gas and the composition**

creates the FOAMED GEL that selectively permits the passage of non-aqueous fluids while inhibiting the passage of aqueous fluids. Preferably, a single injection step only is performed, injecting the composition and the gas concurrently into the formation. (Column 2, lines 3 – 10; Column 2, lines 30 – 38; Column 3, lines 6 – 17; Column 7, lines 53 – 68; Column 8, lines 20 – 50; and Column 9, lines 12 – 46 of Hutchins et. al.).

However, Column 7, lines 53 – 68 of Hutchins et. al. states: "One or more **slugs of a gas** are also injected into the subterranean formation. While the gas slugs are injectable before, during, or after the injection of the foamed gel-forming composition, it is preferred to inject at least some, and more preferentially all, of these slugs after or simultaneously during the injection of the composition. Also preferred is the alternate, sequential injection of one or more slugs of the foamable, gel-forming composition and one or more slugs of the gas. … **The gas slugs foam the composition so that a foamed gel is produced**."

Furthermore, following the injection of the final foamable gel-forming slug, the gel-forming composition is further foamed and **displaced** from the wellbore and into the formation **with a nitrogen gas slug**. (Column 11, lines 54 – 68 of Hutchins et. al.)

With respect to the "composition capable of forming a foamed gel", the composition comprises (a) "an ingredient capable of transforming the composition into a gel", (b) a surfactant capable of foaming the composition, and (c) a delayed **gel degrading** agent. Once the gas and the composition are injected into the formation, the gas interacts with the composition to form a foamed composition. After a period of time, the foamed composition gels to provide the foamed gel and **the delayed gel degrading agent creates pathways in the foamed gel**. At least some of the pathways connect bubbles present in the gel. The presence of the pathways permits the flow of hydrocarbons, in preference to water, "through the foamed gel." (Column 2, lines 10 - 21; Column 3, lines 6 – 17; Column 8, lines 20 - 32 of Hutchins et. al.).

The "ingredient capable of transforming the composition into a gel" is comprised of a cross-linked polymer. Hutchins et. al. notes that the gel-forming composition need only contain either the cross-linkable polymer or the cross-linking agent. "When the cross-linkable polymer or cross-linking agent is omitted from the composition, the omitted material is usually introduced

into the subterranean formation as a separate slug, either before, after, or simultaneously with the introduction of the gel-forming composition." (Column 3, lines 55 – 64 of Hutchins et. al.)

Therefore, the components of the cross-linked polymer may be injected separately into the formation. Alternately, Hutchins et. al. provides **a mixture of the cross-linkable polymer, the cross-linking agent and the delayed gel degrading agent for injection into the formation**. "To avoid prematurely foaming the composition, the **surfactant** is preferably added to the composition on the fly, i.e., **as the composition is being injected** into a subterranean formation." (Column 8, lines 33 – 50; Column 9, lines 12 - 22 of Hutchins et. al.)

There is no suggestion in Hutchins et. al. that the surfactant be injected subsequent to the injection of the other components of the gel-forming composition. As indicated, the only discussion relates to the potential separate injection of the polymer and the cross-linking agent and the sequential injection of the composition with gas slugs.

Accordingly, a number of critical differences are apparent between Hutchins et. al. and the Applicant's claimed method.

First, **Hutchins et. al. provides a single "introducing step" only**. Specifically, Hutchins et. al. describes a single step for the injection of the ingredients of the "gel-forming composition", including the "gelant" (i.e. the "ingredient capable of transforming the composition into a gel") and the surfactant capable of foaming the composition, in order to form the foamed gel in the formation. Although the polymer and the cross-linking agent comprising the "gelant" may be injected separately, at least one of the polymer and the cross-linking agent is injected concurrently with the surfactant. **There is no discussion whatsoever regarding the injection of the "gelant" (i.e. the polymer and the cross-linking agent) and the subsequent injection of a "temporarily stable foam"** as claimed in amended Claim 1.

In this regard, the Examiner refers to Column 3, lines 55 - 64 of Hutchins et. al. as disclosing "first introducing a gelant into the wellbore."

Column 3, lines 55 - 64 of Hutchins et. al. simply provides a discussion of the "gelant" comprised of the cross-linkable polymer and the cross-linking agent. However, as

detailed above, the "gelant" is NOT introduced into the wellbore in isolation, i.e. in a step preceding or prior to "second introducing a temporarily stable foam", as claimed by the Applicant.

Further, the Examiner refers to Column 7, lines 53 - 68 and Column 8, lines 34 - 50 of Hutchins et. al. as disclosing "second introducing a temporarily stable foam into the wellbore."

However, Column 7, lines 53 - 68 of Hutchins et. al. simply describes the injection of one or more "gas slugs" into the formation before, during or after the injection of the foamed gel-forming composition." The "gas slugs" do NOT comprise a "temporarily stable foam" introduced into the wellbore "subsequent to first introducing the gelant," as claimed by the Applicant The gas simply facilitates the foaming of the composition that has already been introduced into the formation.

Further, as detailed above, Column 8, lines 34 - 50 of Hutchins et. al. describes forming the "foamable, gel-forming composition" by mixing the polymer, the cross-linking agent and one or more delayed gel degrading agents and adding the surfactant to the composition "on the fly" "as the composition is being injected into a subterranean formation." Thus, all of the ingredients or components of the "composition capable of forming a foamed gel", including the gelant and the surfactant "capable of foaming the composition" are injected into the formation concurrently or in a single step. A "temporarily stable foam" is NOT introduced into the wellbore "subsequent to first introducing the gelant," as claimed by the Applicant in amended Claim 1.

Second, **the gel-forming composition of Hutchins et. al. and the gas are injected directly into the formation**. The only discussion with respect to "displacement" from the wellbore relates to the use of a **slug of nitrogen gas** for the displacement.

It is respectfully submitted that the description in Hutchins et. al. relating to the use of a gas slug for displacement from the wellbore teaches away from the Applicant's claimed invention, which is expressly intended to be an improvement over the use of gas for such displacement. As discussed in the Application at Page 2, lines 5 - 12:

> "Typically, such chemical blocking agents are comprised of a gel such as a polymer gel or a gelatinous foam. However, the selective placement of these chemical

blocking agents in the desired areas of the formation has been problematic. For instance, the placement of the chemical blocking agent by gas injection typically results in poor placement due to overriding of the gas or fingering of the gas through the blocking agent during the gas injection process. Accordingly, the effectiveness of the gas injection process for properly placing the chemical blocking agent is reduced. None of the available methods for the placement of the chemical blocking agent downhole have been found to be fully satisfactory."

Third, although a gas slug may be used in Hutchins et. al. to displace the composition from the wellbore, **there is no discussion provided in Hutchins et. al. regarding the "overdisplacement" into the formation**, as defined by the Application.

Finally, as claimed in amended Claim 1, the "temporarily stable **foam**" breakdowns to permit the passage of gas through the foam into the wellbore. Meanwhile, the **gelant sets** within the formation to form **a gel block**.

In contrast, Hutchins et. al. provides for the **degradation** of the **gel** as a result of the delayed gel degrading agent. Specifically, the main purpose of the delayed gel degrading agent is to form pathways in the foamed gel in order to connect the bubbles present in the gel. These pathways preferentially favour or permit the flow of a non-aqueous fluid relative to the flow of an aqueous fluid through the foamed gel. Thus, a "gel block" is NOT provided in the formation.

Thus, it is respectfully submitted that all of the features of the Applicant's invention, as claimed in amended Claim 1, are not disclosed or suggested in any manner by Hutchins et. al. Furthermore, it is submitted that these features are also not disclosed or suggested by Weaver et. al. Accordingly, combining Weaver et. al. with Hutchins et. al. does not overcome the deficiencies of Hutchins et. al. as outlined above.

Weaver et. al. teaches the use of various polymeric compositions to modify the permeability and surface characteristics of a formation to prevent or reduce the flow of aqueous fluids through a portion of the formation.

The Examiner states that Hutchins et. al. fails to explicitly teach "wherein the temporarily stable foam is introduced into the subterranean formation so as to over-displace the

gelant from the wellbore and into the formation as claimed." Thus, the Examiner cites Weaver et. al. as teaching the "over displacement." Specifically, the Examiner relies upon Column 21, lines 9 – 24 and Column 49, line 21 - Column 50, line 12 of Weaver et. al. as teaching the claimed "overdisplacement."

More particularly, Weaver et. al. teaches "placing an aqueous, organic or mixed liquid phase containing the polymer adjacent the formation to be treated and displacing or forcing the liquid phase containing the polymer into the formation." (Column 20, lines 61 – 65 of Weaver et. al.).

With respect to Column 21, lines 9 – 24 (cited by the Examiner), Weaver et. al. teaches a "**pre-flush**" **prior** to the use of the polymer to treat the formation. Specifically, a pre-flush containing an "extending agent" which will be adsorbed on the formation, can be used to allow displacement of the liquid phase containing the polymer away from the wellbore or formation surface. In other words, the **polymer** more readily **passes through the zone which has been treated with the pre-flush**.

Accordingly, it is respectfully submitted that the description of the pre-flush is irrelevant to the Applicant's method as claimed in amended Claim 1. The pre-flush is introduced prior to introducing the polymer and is adsorbed on the formation. Further, the subsequently introduced polymer does not "displace" the pre-flush from the wellbore and into the formation. Rather, the polymer passes through the zone of the formation treated with the pre-flush.

Column 49, line 21 - Column 50, line 12 of Weaver et. al. (cited by the Examiner) states that the polymer "should be overdisplaced **using an aqueous fluid, gas or hydrocarbon such as water, nitrogen or lease oil**." Further, Weaver et. al. states that the polymer may be overdisplaced into the formation "using any available fluids such as **an aqueous fluid, gas, hydrocarbon or mixture thereof**." No further description or discussion is provided.

Specifically, Weaver et. al. does not provide any discussion or suggestion whatsoever regarding the use of a "temporarily stable foam" for overdisplacing the polymer of Weaver et. al. into the formation, as claimed in amended Claim 1.

Thus, in summary, neither Hutchins et. al. nor Weaver et. al. describes or suggests "**subsequent** to first introducing the gelant" (comprised of a polymer and a cross-linker), "**second introducing a temporarily stable foam** into the wellbore", as claimed by the Applicant in amended Claim 1. Furthermore, neither provides any discussion whatsoever regarding the use of a "temporarily stable foam" in order to "overdisplace" a gelant from the formation and into the wellbore.

In addition, neither Hutchins et. al. nor Weaver et. al. describes or suggests "providing a set-up period to permit the gelant **to set to form a gel block** in the formation and to permit the temporarily stable foam **to break down** to permit the passage of gas **through the foam** into the wellbore", as claimed by the Applicant in amended Claim 1. Rather, the mechanism of action of each of the compositions of Hutchins et. al. and Weaver et. al. differs significantly from that claimed by the Applicant. In Hutchins et. al., the gel degrades to permit selective fluids to pass therethrough. In Weaver et. al., various compositions are "contacted" with the formation, which modify the permeability and surface characteristics of the formation (Column 9, lines 25 - 39; Column 20, line 49 - Column 21, line 9 of Weaver et. al.).

Given that neither of the references disclose these features of amended Claim 1, it is respectfully submitted that it would not have been obvious to combine the references in the manner set forth by the Examiner in order to provide the Applicant's invention. Rather, there are "critical differences" between the claimed invention and the prior art with respect to both the claimed features and the mechanism of action of the claimed method.

Furthermore, a person having ordinary skill in the art would not combine the references as suggested by the Examiner to provide the Applicant's invention.

Specifically, Hutchins et. al. describes introducing all of the components of the composition into the formation to create a foamed gel, wherein the foamed gel includes a degrading agent such that the foamed gel degrades to provide passages therethrough. In the event that it is desired to displace the composition from the wellbore, Hutchins et. al. expressly instructs the displacement using **a nitrogen gas slug**. Weaver et. al. describes contacting the formation with the polymer and overdisplacing the polymer into the formation using an aqueous fluid, gas or hydrocarbon, **such as water, nitrogen or lease oil**.

Thus, both Hutchins et. al. and Weaver et. al. contemplate displacing a composition into the formation using a gas slug, particularly nitrogen. Accordingly, in the event that Hutchins et. al. was to be modified in view of Weaver et. al., a person skilled in the art would simply further consider the potential use of an aqueous fluid or hydrocarbon (as taught by Weaver et. al.) in place of the nitrogen gas slug (taught by both Hutchins et. al. and Weaver et. al.) to displace the composition into the formation.

Further, given the specific list of "displacing" agents provided by the references, it is submitted that one having ordinary skill in the art would be led away from utilizing a "temporarily stable foam" for this purpose, as claimed in amended Claim 1.

Summary -

Thus, in summary, it is respectfully submitted that neither Hutchins et. al. nor Weaver et. al., alone or in combination, teaches, discloses or suggests the Applicant's method as claimed in amended independent Claim 1. In particular, it is respectfully submitted that neither of the references discloses at least steps (b) and (c) of amended Claim 1, as discussed in detail above. Therefore, it is respectfully submitted that amended independent Claim 1 is allowable and allowance of Claim 1 is respectfully requested.

Further, dependent Claim 2 - 20 depend directly or indirectly from amended independent Claim 1. Thus, it is respectfully submitted that these dependent Claims are allowable for the distinctions defined therein as well as for the reasons supporting the allowability of Claim 1. Accordingly, allowance of all of the dependent Claims is also respectfully requested.

In view of the foregoing amendments and remarks, it is submitted that this Application is in condition for allowance and allowance is respectfully requested.

Respectfully submitted,

RODMAN & RODMAN

/Charles Rodman/
Charles Rodman
Reg. No. 26,798
Applicants' Attorney

Dated: February 11, 2010

Rodman & Rodman
10 Stewart Place
Suite 2CE
White Plains, New York 10603

Phone: (914) 949-7210
Fax: (914) 993-0668

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